Title: Multiplication Matters

Brief Overview:

This unit focuses on the development of concepts for multiplication. Students will develop concepts through the use of literature, manipulatives, and centers. Students will discover how to organize items into an array and translate into a multiplication number sentence understanding the connection to addition. Finally, the students will use their acquired knowledge to communicate their understanding of multiplication through a friendly letter. Students will write to explain a mistake made by, "Mr. Confused" demonstrating their understanding.

NCTM 2000 Principles for School Mathematics:

- **Equity:** *Excellence in mathematics education requires equity - high expectations and strong support for all students.*
- **Curriculum:** *A curriculum is more than a collection of activities: it must be coherent, focused on important mathematics, and well articulated across the grades.*
- **Teaching:** *Effective mathematics teaching requires understanding what students know and need to learn and then challenging and supporting them to learn it well.*
- **Learning:** *Students must learn mathematics with understanding, actively building new knowledge from experience and prior knowledge.*
- **Assessment:** *Assessment should support the learning of important mathematics and furnish useful information to both teachers and students.*
- **Technology:** *Technology is essential in teaching and learning mathematics; it influences the mathematics that is taught and enhances students' learning.*

Links to NCTM 2000 Standards:

- **Content Standards**

Number and Operations

- *Understand numbers, ways of representing numbers, relationships among numbers, and number systems; understand meanings of operations and how they relate to one another; and compute fluently and make reasonable estimates.*

- **Process Standards**

Problem Solving

- *Build new mathematical knowledge through problem solving; solve problems that arise in mathematics and in other contexts; apply and adapt a variety of appropriate strategies to solve problems; and monitor and reflect on the process of mathematical problem solving.*

Reasoning and Proof

- *Recognize reasoning and proof as fundamental aspects of mathematics; make and investigate mathematical conjectures; develop and evaluate mathematical arguments and proofs; and select and use various types of reasoning and methods of proof.*

Communication

- *Organize and consolidate their mathematical thinking through communication; communicate their mathematical thinking coherently and clearly to peers, teachers, and others; and use the language of mathematics to express mathematical ideas precisely.*

Connections

- *Organize and consolidate their mathematical thinking through communication; communicate their mathematical thinking coherently and clearly to peers, teachers, and others; analyze and evaluate the mathematical thinking and strategies of others; and use the language of mathematics to express mathematical ideas precisely.*

Representation

- *Create and use representations to organize, record, and communicate mathematical ideas; select, apply, and translate among mathematical representations to solve problems; and use representations to model and interpret physical, social, and mathematical phenomena.*

Grade/Level:

Grades 3-4

Duration/Length:

Five 60 minute periods

Prerequisite Knowledge:

Students should have working knowledge of the following skills:

- Basic addition facts
- Use of calculators
- Writing a friendly letter

Student Outcomes:

Students will:

- be able to solve a multiplication fact three ways; by drawing a model, in algorithm form, and with a calculator.
- be able to communicate in letter form the correct procedure and solution to a basic multiplication problem.
- work cooperatively in groups or partners and move from student station to the next.

Materials/Resources/Printed Materials:

Day 1:

- Chart paper and a marker
- Carle, Eric. *Draw Me a Star,* Penguin Putnam Books for Young Readers. New York, 1992.
- **Student Resource Sheets #1, 1b, and 2**, *Pre-assessment, K.W.L., and Stars in Action,* one sheet needed for each students
- Timer

- Tiles or any type of manipulative for grouping
- An overhead of **Teacher Resource Sheet #1**, *Wish Upon a Star*
- One milky pen per student
- Black construction paper for each student

Day 2:

- Murphy, Stuart J.. *Too Many Kangaroo Things to Do!* Harper Collins Publisher. New York, 1986.
- Chart paper and a marker
- **Student Resource Sheet #3**, *EMAC* copied back to back, two sheets needed for each student.
- Overhead of **Student Resource Sheet #3**, *EMAC*
- Calculator

Day 3-4:

- Neuschwander, Cindy. *Amanda Bean's Amazing Dream.* Scholastic Press. New York, 1998.
- **Student Resource #4-8**, *Amanda Bean's Multiplication Chart, ___'s Multiplication Chart, Cube Question Response Sheet, Multiplication Race Game Board, Multiplication Race Directions*, one sheet needed for each student
- **Teacher Resource #2-3** *Question Cube Instructions*, *Multiplication Cube Questions* (Teacher Resource #2 give directions for creating a question cube which should be done prior to doing this station)
- Number Cubes for Student Station 3 and 4
- Notebook paper for Station 3
- Crayons for Student Station 4
- Calculators should be available*

Day 5:

- **Student Resource #9-10**, *Friendly Letter Form, Proofreading Checklist*, one sheet needed for each student
- **Teacher Resource #4-5**, *Mr. Confused's letter, Scoring Rubric,* one letter needed for each student, and an overhead of the rubric

Development/Procedures:

Pre-Assessment:

- Prior to beginning day one, students need to complete the pre-assessment found on **Student Resource Sheet #1 and 1b**, *Pre-Assessment and K.W.L.* Remind students that this is an opportunity for you to see what they know so that you know what to teach them.

Day 1:

•Using the completed pre-assessment (**Student Resource Sheet #1**, *Pre-Assessment and K.W.L.***)** create a whole class K.W.L. sheet on chart paper. Record student responses of what they know and want to know about multiplication. This chart can be posted and used throughout instruction to confirm correct concepts and correct misconceptions, to celebrate discoveries of what they wanted to find out, and keep track of what is learned.

•Read the story by Eric Carle, Draw Me a Star. *You will want to preview this book to ensure that the illustrations are appropriate for your class.

•Teach/review with students how to draw a star. Have students model different types of stars as they draw on the overhead.
•Once students are comfortable with drawing at least one type of star, distribute **Student Resource Sheet #2,** *Stars in Action*. Explain to students that they will have two minutes to draw as many stars as they can. Explain that after drawing they will need to find the total of their stars so they should be thinking of a strategy that will make counting their stars easier.
•After estimating how many stars they think they can draw, have students draw stars for two minutes and then use their strategy to find their total number of stars. They should write their actual number and compare this to their estimate.
•Lead a class discussion of strategies used to determine the total. Through this discussion students should discover that even rows and groups will work better than counting one by one. Elicit that the same arrangement of stars can be counted using more than one strategy. For example, **** can be counted by 4's, 3's, etc.

****
****

•Next, use manipulatives such as tiles to help children make the connection between arrays and counting/addition. For example, place 20 tiles on the overhead as 5 groups of 4. Ask students to use a quick way to find how many there are in all. They should use the connection already made that even rows and groups make counting easier and help them connect this to repeated addition. Do several models of this with different numbers as needed and then tie this to multiplication. For example, with 5 groups of 4, help students understand that this is the same as 5x4 and 4+4+4+4+4. Students can use manipulatives at their desks to create the models you make on the overhead projector.
•Give each child a milky pen and a sheet of black construction paper. Students should fold their paper into fourths. Put up **Teacher Resource Sheet #1**, *Wish Upon a Star* overhead. Explain that they will play *Wish Upon A Star*. Students will use the overhead to read to perform a task to play this game. Model this game as often as needed and release students to play in pairs as they are ready.

Day 2:

•Show students the cover of the story, Too Many Kangaroo Things to Do and ask them to predict what they think the story is about and why. As they share, record a few predictions on chart paper that has two columns. The first column is for first predictions and the second is for second predictions after reading page seven of the book.
•Set a purpose for reading and record on chart paper, "While we are reading this story, see if you can figure out what the animals are using to help them solve their problems."
•Read and discuss the purpose set for the story. (Remember to stop at page seven for new predictions and reasons.)
•Using the overhead of **Student Resource Sheet #3**, *EMAC* walk students through solving several multiplication problems as a class. The steps are:

1. Algorithm- write a number sentence ex. 4x6=?
2. Estimation- invite students to estimate or guess the answer quickly and plot this on the number line. ex. 0 50 100;
   Students should know that half-way between 0 and 100 is 50. 4x6 is less than fifty and closer to 0 than to 50.
3. Students should draw an array of the problem to solve.
4. Students should solve on the calculator.
5. Write the actual answer under the algorithm, 24.

•As students are comfortable with this format, give them a list of problems to choose from to continue to develop their skills independently as you work with other students that need more help.

Day 3 and Day 4:

- Show the cover of Amanda Bean's Amazing Dream, and take a few predictions of what they think the story will be about and why. As you read the story, children can continue to predict if they think Amanda will change her mind about multiplication and what will happen to her next.
- Read the story.
- Distribute **Student Resource #4,** *Amanda Bean's Multiplication Chart.*
- As students read the story, they will use this sheet to solve the different multiplication encounters Amanda has. This activity will be part of Student Station #1.
    1) The teacher models this worksheet.
    2) Model the problem of 12 tiles in 12 columns, the first encounter Amanda has with multiplication, in the array column on **Student Resource #4,** *Amanda Bean's Multiplication Chart.*
    4) Write the addition number sentence - 12+12+12+12+12+12+12+12+12+12+12+12=144
    5)Finally write the multiplication number sentence and solve. 12 x 12 = 144
- Introduce Student Station #2.
    1) Students will use **Student Resource #5**, ___*'s Multiplication Chart.*
    2) The students will take this worksheet and find items in the classroom or think of items in their lives that they could count easier using multiplication. They complete this the same way as **Student Resource #4,** *Amanda Bean's Multiplication Chart.* Model one example for the class (Examples of items in the room could be the stars on the flag, baskets or shelves of books with an even number of books, desks in even groups etc.)
- Introduce Student Station #3
    1) This will be the cube station where students will solve open-ended word problems with a written response. Directions for creating a question cube can be found on **Teacher Resource #2**, *Question Cube Instructions.* Questions for the cube are on **Teacher Resource #3**, *Cube Questions* .
    2) Students should roll a number cube to determine which question(s) they should respond to. Students can record their answers on **Student Resource #6**, *Multiplication Cube Open Ended Response Sheet.*
- Introduce Student Station #4
    1) Students play this game with a partner and each student needs **Student Resource #7,** *The Multiplication Race Game Board*, and a crayon. Each pair needs a set of number cubes and a copy of **Student Resource #8**, *Multiplication Race Directions* directions to the game.

*After introducing the centers and setting expectations for each group, you can use this time to pull small groups for reinforcement or to introduce new concepts. You can also make observations of student understanding while they are in centers.

Day 5

- See Performance Assessment.

Performance Assessment:

- Students will write a friendly letter to respond to the "Mr. Confused" writing prompt. (see **Teacher Resource #4,** *Mr. Confused's letter*)
- First, review with students, **Teacher Resource #4,** *Mr. Confused's letter*. Next, post and understand how they can earn all four points on the rubric. Leave **Teacher Resource Sheet #5**, *Scoring Rubric* up on the overhead for student's to refer to during testing.
- Students will use the **Student Resource #9**, *Friendly Letter Form* to write their letter to Mr. Confused.
- Students are expected to communicate to "Mr. Confused" in letter format and explain how he incorrectly multiplied. The student is to explain how to multiply the problem and to communicate in numerous ways the correct way to solve the problem.
- This will allow the students the opportunities to show how much they have learned about multiplication and the variety of methods and strategies they understand and can apply.
- Each student is to proof read his/her rough draft using **Student Resource #10,** *Proofreading Checklist.*
- **Teacher Resource Sheet #5**, *Scoring Rubric.*
- The student will then write the final copy and turn it in for a grade.

Extension/Follow Up:

- Students may write a letter in their journal to a student that is absent explaining everything they learned about multiplication that day. This may be read to the student upon his/her return back school.
- Students may make up their own multiplication word problems. The teacher approves their problems and then they switch with a partner and solve each others' problems.
- Students may plan a class pizza party.
- Additional Books that can also be used:
  Anno's Mysterious Multiplying Jar, by Masaichiro and Mitsumasa Anno
  The 12 Circus Rings, by Seymour Chwast
  Each Orange Has 8 Slices, by Paul Giganti, Jr.
  What Comes in 2's, 3's, & 4's, by Suzanne Aker
  Counting Kangaroos, by Joy Hulme
  Sea Squares, by Joy Hulme
  The Doorbell Rang, by Pat Hutchins
- Additional Computer Disks are available to help teach the math facts.
  Multiplication Rock

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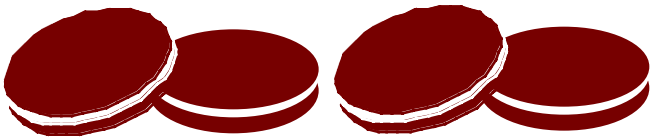
PRE-ASSESSMENT

Name: _____
Date: _____

Please solve the following problem in your own words. Solve the problem as many ways as you know how.



You have a bag of cookies. You have five friends and you want to give each friend four cookies. How many cookies will you need?

Turn your paper over. On the back is a Know-Want-Learn Chart. Under the Know column , fill in everything you know about multiplication. List as many things you can remember. Under the Want column, fill in everything you want to know about multiplication. Again, list as many things as you want to know.

KWL - Multiplication

Student Resource #1b

What I **KNOW** about Multiplication	What I **WANT to Know** about Multiplication	What I **LEARNED** about Multiplication

Name _____ Date _____

Name: _____

Student Resource Sheet #2

STARS IN ACTION

Estimate: _____ Actual: _____

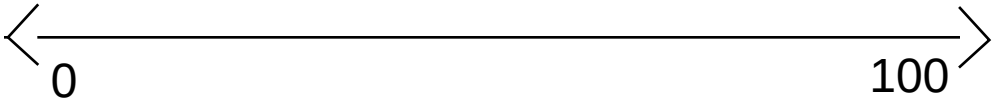
Wish Upon a Star

Your mission is to create galaxies with your partner in each section of your paper

1) Partner one rolls a number cube.
2) This number will be how many rows of stars you will need.
3) Partner two rolls a number cube.
4) This number will be how many stars are in each row.
5) Next, draw the array (your galaxy) that fits the two numbers rolled on the cubes.
6) Next, write the addition number sentence that your array represents.
7) Then, write the problem out in words. (For example, 6 sets of 3)
8) Finally, write a multiplication number sentence that your array represents.

When you have followed these directions for each section of your paper, you have successfully completed your mission!

Estimate



Algorithm

Model / Diagram

Calculator Solution

Adapted from an activity created by Molly Ketterer, Howard County Public Schools

Amanda Bean's Multiplication Chart

Event	Array	Addition Number Sentence	Multiplication Number Sentence
Counter Top Tiles			
Pickles in Jars			
Sheep's Bicycle Wheels			
Balls of Yarn			

_____’s Multiplication Chart

Your Name

Event	Array	Addition Number Sentence	Multiplication Number Sentence

Teacher Resource #2

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?Question Cube Instructions?

??

1. Acquire a cardboard cube shaped box and reinforce the edges with tape.

2. Using wrapping paper, butcher or construction paper, wrap a cube shaped cardboard box like a present. (If the paper is laminated first, it will be more durable.)

3. Tape or velcro library pockets to each side of your cube.

4. Number the pockets 1-6 and place question cards inside.

Ta Da! You now have a question cube which can be used to motivate your students to answer questions across disciplines! There are many possibilities for how your cube can be used in your classroom.

Cube Questions

Teacher Resource #3

You are planning a party. Four friends are coming. If you think each person will eat 5 cookies, how many cookies will you need? **Challenge:** If cookies come in packages of 12, how many packages will you need to buy to have enough cookies?

Card 1

You have 7 shelves in your room. On each shelf you have 5 toys. How many toys do you have? **Challenge:** If you have 5 shelves and 30 toys, how many toys will be on each shelf?

Card 2

You are baking three apple pies for your Thanksgiving meal. The recipe calls for 6 apples for each pie. How many apples do you need? **Challenge:** If you have 24 apples, how many pies can you bake?

Card 3

You are playing Uno with your friends. Each player gets 7 cards. If 4 of you are playing, how many cards are passed out? **Challenge:** If there are 21 cards passed out, how many people are playing?

Card 4

You have a garden. If you have 6 rows of flowers with 7 flowers in each row, how many flowers do you have? **Challenge:** If you have 14 flowers, with 7 in each row how many rows do you have?

Card 5

You are reading a book. If you read 4 pages everyday for 6 days, how pages will you read? **Challenge:** If a person read 36 pages in 6 days and read the same number of pages each day, how many pages did they read each day?

Card 6

Cube Questions Answer Key

Card 1 - 20 Cookies (4*5)
Challenge - 2 Packages

Card 2 - 35 Toys (7*5)
Challenge - 6 Toys

Card 3 - 18 Apples (3*6)
Challenge - 4 Pies

Card 4 - 28 Cards (7*4)
Challenge - 3 People

Card 5 - 42 Flowers (6*7)
Challenge - 2 Rows

Card 6 - 24 Pages (4*6)
Challenge - 6 Pages

Name:_____

Date:_____

??

?Question Cube Response Sheet?

??

Directions: Roll a number cube to discover which question you will get to answer. Take the card out of the correct numbered pocket. Write the question on the lines below and return the card to the correct pocket. Then, do your best to answer the question in complete sentences using math words to explain your thinking. Draw a labeled picture(s), and remember to show the number sentence(s) that helped you solve the problem. On the back of this paper, try the challenge problem! Remember to show your thinking as many labeled ways as you can. I know my students are up for the challenge!

Question: #____

_____

_____

_____

My Thinking in Labeled Pictures:

My Thinking in Words:

_____

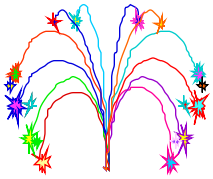
_____

_____

_____

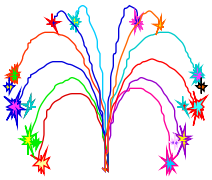
_____

My Number Sentence(s):

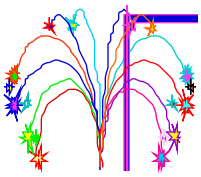


Multiplication Race

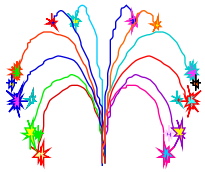
Player:_____



Date:_____



Multiplication Race



You and your partner each need a game board and a crayon. You will also need one pair of number cubes.

1. Player One rolls both number cubes. One number tells the number of rows and the other number tells the number of boxes in each row that you will draw a box around on your game board.

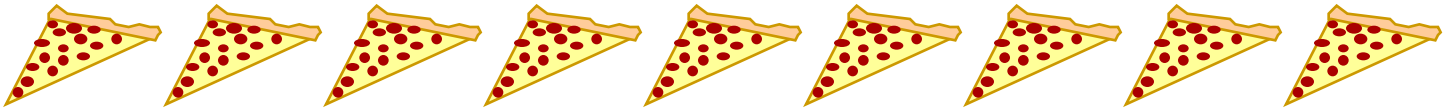
2. On your game board draw a box around the array that represents the multiplication number sentence made by your number cubes.

3. Write the number sentence that represents your box inside the box you have drawn with the answer.

4. Player Two follows directions 1-3.

5. Players keep playing until time is called or a player has covered their whole board. The winner when time is called is the player who has covered more of their board.

Example: If I roll a 3 and a 4 I know I need to draw a box around 3 rows with four squares in each row. Inside my box I will write 3x4=12 because I know that I have three groups of four.

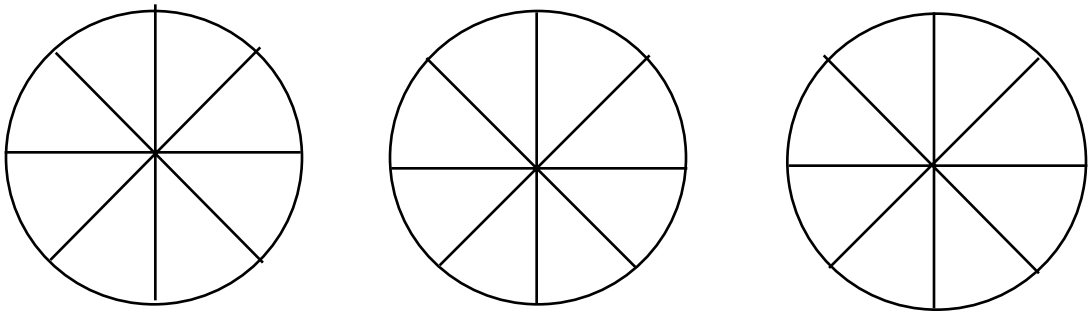


Directions: Mr. Confused has written you a letter explaining how many pizzas we would need to order for a pizza party. Unfortunately, Mr. Confused is not as good at multiplication as you are, and he has made a mistake. Read his letter carefully. Then, write a letter to Mr. Confused clearly explaining to him his mistake in the same ways we have learned in class. Remember that you must have at least 3 supporting details of explanation and use the correct friendly letter format.

Some Month 12, 2001

Dear Student,

Hello, I thought I would help out your class and figure out how many pizzas we would need to order to feed your whole class for a party. I called the pizza place and discovered that there are 8 pieces of pizza in a large pizza. I figured out that we would need 3 pizzas to feed everyone in our class one piece of pizza. We have 28 students in our class and I believe that this will be plenty of pizza for us. I drew a diagram to show you our pizzas.



Pizza 1 Pizza 2 Pizza 3

I used multiplication to discover that this would be enough pizza. I have 3 pizzas and 8 slices in each so, I know that I have enough pizza to feed all 28 students. I hope you enjoy eating your pizza!

Sincerely,
Mr. Confused

Writing to Inform
Scoring Rubric

The student:

4 communicates at least three different ways for the multiplication problem to be solved.

uses math language that shows he/she has a complete knowledge of multiplication.

includes all elements of the friendly letter format.

has no errors in punctuation, capitalization, and spelling.

3 communicates two different ways for the multiplication problem to be solved.

uses some math language that shows he/she has a complete knowledge of multiplication.

includes only three parts of the friendly letter format.

has very few errors in punctuation, capitalization, and spelling.

2 communicates one way for the multiplication problem to be solved.

rarely uses math language that shows he/she has a complete knowledge of multiplication.

includes only two parts of the friendly letter format.

has many errors in punctuation, capitalization, and spelling.

1 has little or no response.

Student Resource #9

Friendly Letter Form

_____

Date

_____,

Opening

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____,

Closing

_____

Your Name

Proofreading Checklist

1) I capitalized the beginning of all my sentences.

Yes No

2) I used the correct punctuation at the end of each sentence.

Yes No

3) I have made complete sentences that make sense.

Yes No

4) I have used spelling strategies to make sure my words are spelled correctly.

Yes No

5) I have included at least three supporting details.

Yes No

6) I have completed all parts of the friendly letter.

Yes No

7) I have a topic sentence and a closing sentence.

Yes No

8) I have indented all paragraphs.

Yes No